

AMENDMENTS TO THE CLAIMS:

Claims 1-7 (cancelled)

8. (New) A method of forming a pipe, comprising:

feeding a workpiece, having a hole therein, between an upper roll and two lower rolls of a bending machine, with said two lower rolls being parallel to each other and parallel to said upper roll;

moving said workpiece by rotating said two lower rolls while supporting said workpiece with said upper roll and said two lower rolls;

bending said workpiece under pressure of said upper roll and said two lower rolls such that said workpiece is formed into a pipe member having a required radius at a portion where said hole is located; and then

pressing said pipe member with said upper roll and said two lower rolls such that no bending action is applied to said portion where said hole is located, and such that said pipe member is rolled whereby other portions of said pipe member are made to have a radius coinciding with the radius at said portion where said hole is located.

9. (New) The method according to claim 8, wherein

when said workpiece has a hole having a larger diameter and a hole having a smaller diameter, a portion of said workpiece at said hole having said larger diameter corresponds to said portion where said hole is located, and a portion of said workpiece at said hole having said smaller diameter corresponds to one of said other portions.

10. (New) The method according to claim 9, wherein

pressing said pipe member with said upper roll and said two lower rolls such that no bending action is applied to said portion where said hole is located, and such that said pipe member is rolled whereby other portions of said pipe member are made to have a radius coinciding with the radius at said portion where said hole is located, comprises feeding said pipe member in plural passes between said upper roll and said two lower rolls, with each of said passes corresponding to a step-wise reduction of a distance between said upper roll and said two lower rolls.

11. (New) The method according to claim 10, wherein

bending said workpiece under pressure of said upper roll and said two lower rolls such that said workpiece is formed into a pipe member having a required radius at a portion where said hole is located comprises

(i) with said upper roll shifted to one side from a central position between said two lower rolls and while feeding said workpiece in a going path, rolling said workpiece by pressing said workpiece between said upper roll and said two lower rolls, and bending one end of said workpiece by pressing said one end between said upper roll and said two lower rolls, and then

(ii) with said upper roll shifted to another side from said central position between said two lower rolls and while feeding said workpiece in a return path, rolling said workpiece by pressing said workpiece between said upper roll and said two lower rolls, and bending another end of said workpiece by pressing said another end between said upper roll and said two lower rolls.

12. (New) The method according to claim 9, wherein

bending said workpiece under pressure of said upper roll and said two lower rolls such that said workpiece is formed into a pipe member having a required radius at a portion where said hole is located comprises

(i) with said upper roll shifted to one side from a central position between said two lower rolls and while feeding said workpiece in a going path, rolling said workpiece by pressing said workpiece between said upper roll and said two lower rolls, and bending one end of said workpiece by pressing said one end between said upper roll and said two lower rolls, and then

(ii) with said upper roll shifted to another side from said central position between said two lower rolls and while feeding said workpiece in a return path, rolling said workpiece by pressing said workpiece between said upper roll and said two lower rolls, and bending another end of said workpiece by pressing said another end between said upper roll and said two lower rolls.

13. (New) The method according to claim 8, wherein

bending said workpiece under pressure of said upper roll and said two lower rolls such that said workpiece is formed into a pipe member having a required radius at a portion where said hole is located comprises

(i) with said upper roll shifted to one side from a central position between said two lower rolls and while feeding said workpiece in a going path, rolling said workpiece by pressing said workpiece between said upper roll and said two lower rolls, and bending one end of said workpiece by pressing said one end between said upper roll and said two lower rolls, and then

(ii) with said upper roll shifted to another side from said central position between said two lower rolls and while feeding said workpiece in a return path, rolling said workpiece by pressing said workpiece between said upper roll and said two lower rolls, and bending another end of said workpiece by pressing said another end between said upper roll and said two lower rolls.

14. (New) The method according to claim 13, wherein

pressing said pipe member with said upper roll and said two lower rolls such that no bending action is applied to said portion where said hole is located, and such that said pipe member is rolled whereby other portions of said pipe member are made to have a radius coinciding with the radius at said portion where said hole is located, comprises feeding said pipe member in plural passes between said upper roll and said two lower rolls, with each of said passes corresponding to a step-wise reduction of a distance between said upper roll and said two lower rolls.

15. (New) The method according to claim 14, wherein

(i) with said upper roll shifted to one side from a central position between said two lower rolls and while feeding said workpiece in a going path,

(a) rolling said workpiece by pressing said workpiece between said upper roll and said two lower rolls comprises pressing said workpiece between said upper roll and said two lower rolls with said upper roll and two lower rolls being spaced by a first distance, and

(b) bending one end of said workpiece by pressing said one end between said upper roll and said two lower rolls comprises pressing said workpiece between said upper roll and said two

lower rolls with said upper roll and two lower rolls being spaced by a second distance which is less than said first distance, and

(ii) with said upper roll shifted to another side from said central position between said two lower rolls and while feeding said workpiece in a return path,

(a) rolling said workpiece by pressing said workpiece between said upper roll and said two lower rolls comprises pressing said workpiece between said upper roll and said two lower rolls with said upper roll and two lower rolls being spaced by said first distance, and

(b) bending another end of said workpiece by pressing said another end between said upper roll and said two lower rolls comprises pressing said workpiece between said upper roll and said two lower rolls with said upper roll and two lower rolls being spaced by said second distance.

16. (New) The method according to claim 13, wherein

(i) with said upper roll shifted to one side from a central position between said two lower rolls and while feeding said workpiece in a going path,

(a) rolling said workpiece by pressing said workpiece between said upper roll and said two lower rolls comprises pressing said workpiece between said upper roll and said two lower rolls with said upper roll and two lower rolls being spaced by a first distance, and

(b) bending one end of said workpiece by pressing said one end between said upper roll and said two lower rolls comprises pressing said workpiece between said upper roll and said two lower rolls with said upper roll and two lower rolls being spaced by a second distance which is less than said first distance, and

(ii) with said upper roll shifted to another side from said central position between said two lower rolls and while feeding said workpiece in a return path,

(a) rolling said workpiece by pressing said workpiece between said upper roll and said two lower rolls comprises pressing said workpiece between said upper roll and said two lower rolls with said upper roll and two lower rolls being spaced by said first distance, and

(b) bending another end of said workpiece by pressing said another end between said upper roll and said two lower rolls comprises pressing said workpiece between said upper roll and said two lower rolls with said upper roll and two lower rolls being spaced by said second distance.

17. (New) The method according to claim 8, wherein pressing said pipe member with said upper roll and said two lower rolls such that no bending action is applied to said portion where said hole is located, and such that said pipe member is rolled whereby other portions of said pipe member are made to have a radius coinciding with the radius at said portion where said hole is located, comprises feeding said pipe member in plural passes between said upper roll and said two lower rolls, with each of said passes corresponding to a step-wise reduction of a distance between said upper roll and said two lower rolls.

18. (New) An apparatus for forming a pipe, comprising:
an upper roll, and two lower rolls which are parallel to each other and parallel to said upper roll so as to be vertically opposed said upper roll;
first actuators for rotating said upper roll and said two lower rolls;
a second actuator for raising and lowering said upper roll or said two lower rolls;
a third actuator for horizontally moving said upper roll or said two lower rolls; and
a control unit for controlling said first, second and third actuators based on a position of a hole in a workpiece such that the workpiece is to be formed into a pipe by
(i) feeding the workpiece between said upper roll and said two lower rolls,
(ii) moving the workpiece by rotating said two lower rolls while supporting the workpiece with said upper roll and said two lower rolls;
(iii) bending the workpiece under pressure of said upper roll and said two lower rolls such that the workpiece is formed into a pipe member having a required radius at a portion where the hole is located; and then
(iv) pressing the pipe member with said upper roll and said two lower rolls such that no bending action is applied to the portion where the hole is located, and such that the pipe member is rolled whereby other portions of the pipe member are made to have a radius coinciding with the radius at the portion where the hole is located.

19. (New) The apparatus according to claim 18, wherein
when the workpiece has a hole having a larger diameter and a hole having a smaller diameter, said control unit is for controlling said first, second and third actuators based on a position of the hole having the larger diameter such that a portion of the workpiece at the hole having the larger diameter corresponds to the portion where the hole is located, and a portion of the workpiece at the hole having the smaller diameter corresponds to one of the other portions.

20. (New) The apparatus according to claim 19, wherein said control unit is for controlling said first, second and third actuators such that

pressing the pipe member with said upper roll and said two lower rolls such that no bending action is applied to the portion where the hole is located, and such that the pipe member is rolled whereby other portions of the pipe member are made to have a radius coinciding with the radius at the portion where the hole is located, comprises feeding the pipe member in plural passes between said upper roll and said two lower rolls, with each of the passes corresponding to a step-wise reduction of a distance between said upper roll and said two lower rolls.

21. (New) The apparatus according to claim 20, wherein said control unit is for controlling said first, second and third actuators such that

bending the workpiece under pressure of said upper roll and said two lower rolls such that the workpiece is formed into a pipe member having a required radius at a portion where the hole is located comprises

(i) with said upper roll shifted to one side from a central position between said two lower rolls and while feeding the workpiece in a going path, rolling the workpiece by pressing the workpiece between said upper roll and said two lower rolls, and bending one end of the workpiece by pressing the one end between said upper roll and said two lower rolls, and then

(ii) with said upper roll shifted to another side from the central position between said two lower rolls and while feeding the workpiece in a return path, rolling the workpiece by pressing the workpiece between said upper roll and said two lower rolls, and bending another end of the workpiece by pressing the another end between said upper roll and said two lower rolls.

22. (New) The apparatus according to claim 19, wherein said control unit is for controlling said first, second and third actuators such that

bending the workpiece under pressure of said upper roll and said two lower rolls such that the workpiece is formed into a pipe member having a required radius at a portion where the hole is located comprises

(i) with said upper roll shifted to one side from a central position between said two lower rolls and while feeding the workpiece in a going path, rolling the workpiece by pressing the workpiece between said upper roll and said two lower rolls, and bending one end of the workpiece by pressing the one end between said upper roll and said two lower rolls, and then

(ii) with said upper roll shifted to another side from the central position between said two lower rolls and while feeding the workpiece in a return path, rolling the workpiece by pressing the workpiece between said upper roll and said two lower rolls, and bending another end of the workpiece by pressing the another end between said upper roll and said two lower rolls.

23. (New) The apparatus according to claim 18, wherein said control unit is for controlling said first, second and third actuators such that

bending the workpiece under pressure of said upper roll and said two lower rolls such that the workpiece is formed into a pipe member having a required radius at a portion where the hole is located comprises

(i) with said upper roll shifted to one side from a central position between said two lower rolls and while feeding the workpiece in a going path, rolling the workpiece by pressing the workpiece between said upper roll and said two lower rolls, and bending one end of the workpiece by pressing the one end between said upper roll and said two lower rolls, and then

(ii) with said upper roll shifted to another side from the central position between said two lower rolls and while feeding the workpiece in a return path, rolling the workpiece by pressing the workpiece between said upper roll and said two lower rolls, and bending another end of the workpiece by pressing the another end between said upper roll and said two lower rolls.

24. (New) The apparatus according to claim 23, wherein said control unit is for controlling said first, second and third actuators such that

pressing the pipe member with said upper roll and said two lower rolls such that no bending action is applied to the portion where the hole is located, and such that the pipe member is rolled whereby other portions of the pipe member are made to have a radius coinciding with the radius at the portion where the hole is located, comprises feeding the pipe member in plural passes between said upper roll and said two lower rolls, with each of the passes corresponding to a step-wise reduction of a distance between said upper roll and said two lower rolls.

25. (New) The apparatus according to claim 24, wherein said control unit is for controlling said first, second and third actuators such that

(i) with said upper roll shifted to one side from a central position between said two lower rolls and while feeding the workpiece in a going path,

(a) rolling the workpiece by pressing the workpiece between said upper roll and said two lower rolls comprises pressing the workpiece between said upper roll and said two lower rolls with said upper roll and two lower rolls being spaced by a first distance, and

(b) bending one end of the workpiece by pressing the one end between said upper roll and said two lower rolls comprises pressing the workpiece between said upper roll and said two lower rolls with said upper roll and two lower rolls being spaced by a second distance which is less than the first distance, and

(ii) with said upper roll shifted to another side from the central position between said two lower rolls and while feeding the workpiece in a return path,

(a) rolling the workpiece by pressing the workpiece between said upper roll and said two lower rolls comprises pressing the workpiece between said upper roll and said two lower rolls with said upper roll and two lower rolls being spaced by the first distance, and

(b) bending another end of the workpiece by pressing the another end between said upper roll and said two lower rolls comprises pressing the workpiece between said upper roll and said two lower rolls with said upper roll and two lower rolls being spaced by the second distance.

26. (New) The apparatus according to claim 23, wherein said control unit is for controlling said first, second and third actuators such that

(i) with said upper roll shifted to one side from a central position between said two lower rolls and while feeding the workpiece in a going path,

(a) rolling the workpiece by pressing the workpiece between said upper roll and said two lower rolls comprises pressing the workpiece between said upper roll and said two lower rolls with said upper roll and two lower rolls being spaced by a first distance, and

(b) bending one end of the workpiece by pressing the one end between said upper roll and said two lower rolls comprises pressing the workpiece between said upper roll and said two lower rolls with said upper roll and two lower rolls being spaced by a second distance which is less than the first distance, and

(ii) with said upper roll shifted to another side from the central position between said two lower rolls and while feeding the workpiece in a return path,

(a) rolling the workpiece by pressing the workpiece between said upper roll and said two lower rolls comprises pressing the workpiece between said upper roll and said two lower rolls with said upper roll and two lower rolls being spaced by the first distance, and

(b) bending another end of the workpiece by pressing the another end between said upper roll and said two lower rolls comprises pressing the workpiece between said upper roll and said two lower rolls with said upper roll and two lower rolls being spaced by the second distance.

27. (New) The apparatus according to claim 18, wherein said control unit is for controlling said first, second and third actuators such that

pressing the pipe member with said upper roll and said two lower rolls such that no bending action is applied to the portion where said hole is located, and such that the pipe member is rolled whereby other portions of the pipe member are made to have a radius coinciding with the radius at the portion where the hole is located, comprises feeding the pipe member in plural passes between said upper roll and said two lower rolls, with each of the passes corresponding to a step-wise reduction of a distance between said upper roll and said two lower rolls.